Multiple rocket launcher 9K57 The Hurricane

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MLRS (reactive **system** multiple rocket launchers) "Hurricane" is intended to defeat manpower, armored and light armored vehicles and armored infantry units and the enemy on the march in concentration areas, the destruction of the team Fri, military facilities and communication centers, remote installation of antipersonnel and antitank landmines in war zones at a distance of 10 — 35 thousand meters

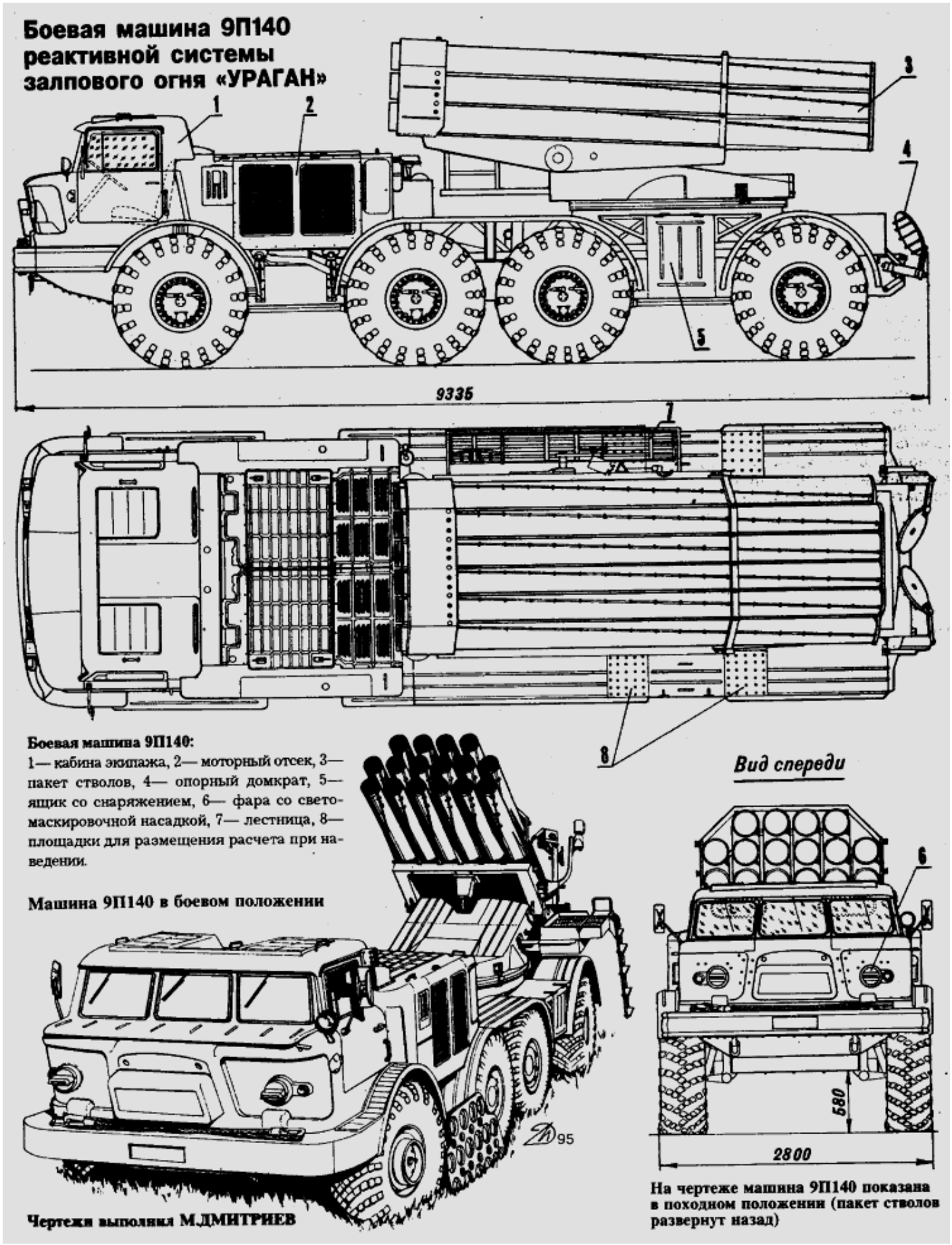
Taking into account the enacting Field reactive system M-21c 1963, Tula State Research Institute of Machine Building A clear in 1963-1964 in an active manner spent prospecting in order to investigate the ability of the creation of a more long-range and strong system on the number of explosives in a volley, with which you can would be resolved in an expeditious manner combat tasks at ranges from 10 to 40 thousand m

In the Department of Mechanical Engineering in June 1964 sent to the "Project Field multiple rocket launchers" Hurricane ", which has the range projectile 35 thousand meters draft of the proposed system, which has a higher maneuverability, speed up to 70 km / h, the highest throughput and the ability to opening salvo fire to a small clearance time. This system can be used to defeat unsheltered or sheltered in field installations manpower, firepower, tanks and nuclear and chemical weapons and other objects and enemy targets at ranges of up to 40 thousand m

By order of the Defense Ministry (MOU) on 28 December 1966, in 1967, began the scientific research project "Creation of complex high-precision missile salvo fire" Hurricane "(HB-121-66). Work completed in December 1967 with the proof of the ability of get asked traits, theoretical elaborations, bench testing of engines, devices, offices, delay disclosure stabilizer aerodynamic blowdown and fire modeling shells. system is recommended to carry out R & D (research and development work).

The results of the work approved number of section 1 subsection 1 NTS Defense Industry Ministry and the theme recommended for development work after the removal of the identified shortcomings.

By order of the Ministry of Machinery Industry and the Ministry of General Machine Building number 18/94 in 1968, a preliminary design has been developed missile systems of salvo fire "Hurricane." In September of the same year the work recommended to carry out development activities (from the document TULGOSNIITOCHMASH (Tula) the early 1970's.).



In 1969 — the beginning of 1970 have carried out work on the formulation and adjustment of TTT for development work: "Army MLRS" "Grad-3" (first in 1970 changed to "The Hurricane"). Apparently, this is a

tactical and technical requirements of the military unit number 0010 64176. The system had to enter combat vehicle, command vehicle, transport vehicle and Arsenalnoe equipment. Proposed to use the following types of warheads shells: cluster fragmentation acts Blast (this is crushing the case), cassette, designed for remote mining. The decision to develop other types of combat units (petrol, cumulative, campaigning in spec. Filling) had taken the Ministry of Defence and the Ministry of Machine Building in the 2nd quarter of 1970, according to the results of preliminary design. The design of shells to be used alone for all combat troops solid rocket engine with a fixed nozzle in the whole range of operational temperatures. Interchangeable nozzles were not. As a base MRL proposed to use the chassis ZIL-135LM. During the conceptual design had to have been working on combat vehicle and transport machinery crawler tractor carrier MT-S (version tactical and technical requirements for the Multiple Launch Rocket System "Grad-3" ("Hurricane") and the terms of reference for revision commander's car). The number of guides was equated 20 pcs. when using the chassis of ZIL-135LM and 24 pc. Chassis With MT. But clearly the number of guide should be specified after consideration of preliminary design. To transport the machine as well as the base of wheeled chassis KrAZ-253.

From a letter Ganicheva AN (TULGOSNIITOCHMASH) Yelagin (Grau) in V / h 64176, it became clear that the Department of Mechanical Engineering and the Ministry of defense industry were approved by the following artists on multiple launch rocket systems "Grad-3":

Department of Mechanical Engineering:
Scientific-Research Institute of Chemical Technology (S / I A-7210, Capital Region, Moscow Region) for testing the powder charge and ignition system;
Factory "Red Army" and State Design Bureau of Instrument (H / I B-8475, Leningrad) for developing means of ignition;
Kazan Research Institute of Chemical Industry (p / B-2281, Kazan) for lifting charge to the head of the tape;
Plant named after Maslennikov (p / P-6833, Kuibyshev) for the creation of a contact fuze acts fragmentation warhead, the remote handset mechanical type cassette warhead;

Institute "Geodesy" (p / P-6766, Capital, Krasnoarmejsk) tests and evaluation of the effectiveness of the warhead;
Scientific-Research Institute "Search" (p / B-8921, Leningrad) for testing the contact fuze for bomblets from cluster warhead;
A Red Army Research Institute of Mechanization (p / A-7690, Capital, Krasnoarmejsk) equipment for testing high-explosive warhead, a bursting charge for bomblets from cluster warhead;
Orsk Engineering Works (p / P-6286, Orenburg region, Orsk) for the production of shells and warheads engines.

Ministry of Defense Industry:
Perm Machine-Building Plant named after VI Lenin (p / P 6760, Perm) for transport and combat vehicles;
All-Union Scientific Research Institute "Signal" (p / A-1658, Vladimir region, Carpet) on completion of the commander's machine.

Work on the creation of MLRS "Hurricane" were made on the basis of a decree of the USSR from 21.01.1970 № 71-26 (Order of the Ministry of Machine Building number 33 of 28.01.1970).

In order to check the activities that are associated with the work to improve the range of fire, in January-February 1971 were planned shooting at 30 pc. MLRS shells "Hurricane" of ballistic installation placed on a gun carriage ML-20. Were to be delivered shells with three types of feathers:
— blade type, thickness 7 mm pen, pen disclosure to the longitudinal axis of the projectil
e at an angle of 90 °;
— Scheme shells "Grad";
— combined (combining the projectile tail blade type and the "Castle").

During the purging of the Central Institute of options aerohydrodynamical shells have three kinds of feathers have received positive results. With all of this in store resistance was about 12 percent.

In 1972, the Municipal Institute of Tula precise engineering work performed on HB2-154-72 "Single-channel angular stabilization system for shells" Grad "and" Hurricane "(Q1 1972 — the start of work, the 2nd quarter of 1973 — the end) .

In 1972, finding single-channel angular stabilization conducted on two fronts:
— based on the angular velocity sensor using a gas-dynamic executive bodies;
— based on the contact angle sensor using a pulsed powder executive.

According to the report of the Tula Municipal Research Institute of Mechanical Engineering clear about the work in 1972, this year carried out theoretical calculations, modeling of analog electrical machines, experimental laboratory studies of single-channel angular stabilization system, as portions of it for unguided rocket projectiles like "Hurricane" and "Grad" . Led to major system requirements and system elements.

The system consisted of электроннопреобразовательный stabilization unit, rotary encoder, the executive bodies of the gas-dynamic type or pulse type.

It was determined that the introduction of a single-channel system stabilization in shells "Hurricane" and "Grad" improves 1.5-2 times their properties on accuracy of fire.

All the elements of the system angular stabilization developed drawings, mock-made standards and tested in laboratory conditions. By the time of preparation of the report was carried out either party creation of blocks of single-channel angular stabilization system for flight testing.

In 1972, by order of the head of the Second Head of the Ministry of Machine Building number 17 dated 20.12.1970, made TulgosNIItochmashem research project on "Investigation of ways for the creation of long-range missiles systems," Hurricane "and" Castle "(HB2-110-71g).

In accordance with a motivated task, carried out theoretical and experimental studies have demonstrated the possibility of growth-range firing missiles systems "Hurricane" and "Castle" by the use of high-momentum fuel and strong materials for the production of housing.

In 1972, recommended a developmental work on the development of "Hurricane" (probably meaning the development of missiles or missile) with a range increased to 40 thousand m

In 1972 he graduated from the factory working off and the system was presented to the landfill-troop tests including:
— unguided missiles with cluster fragmentation act (weight 80-85 kg) and high explosive (weight 100-105 kg) warhead;
— BM 9P140 installed on the chassis ZIL-135LM;
— Freight 9T452 installed on the chassis ZIL-135LM;
— Arsenalnoe equipment.

During the factory were working off the system properties that met the main tactical and technical requirements:
— long range shooting projectiles having explosive fragmentation warhead — 34 thousand meters, tape warhead — 35 thousand meters;
— patterning:
shell having a high-explosive warhead: Toward Wb / A = 1/174, for range Bq / X = 1/197;
shell having a cluster warhead: Toward Wb / A = 1/152, for range Bq / X = 1/261;
— the reduced area of damage projectile with cluster warhead at the approach of combat element to the target 85-90 degrees:
manpower located openly — 22090 m2 (Eud. kgm/sm2 = 10);
military equipment — 19270 m2 (Eud. = 135 kgm/sm2);
— the reduced area of damage projectile with high-explosive warhead:
military equipment — 1804 m2 (Eud = 240kgm/sm2);
— the size of the funnel:
depth of 4.8 m;
width of 8 m

Fighting machine has 18 guides, time volley — 9 seconds Ammunition for transport and loading vehicle ammunition shells — 1 set.

Fighting vehicle was developed under the control of head designer Kalachnikova Yuri Nikolaevich.

The system is constantly being upgraded — for example, there are now a number of modifications of missiles, warheads and projectiles to the data.

At the current time MLRS 9K57 "Hurricane" is in service in the Russian, Kazakh, Belarusian, Ukrainian, Yemeni armies, possibly also in the Syrian army.

MRLS "Hurricane" is widely used in Afghanistan in combat. First, the 1980s it launched the Syrian military and applied for the initial stage of the war with Israel. The system used federal troops in Chechnya. According to public data last time the system was used in the Russian army in 2008 during the Georgian-South Ossetian conflict.

In Ukraine, conducted the installation is modified by an artillery unit at its plant KrAZ-6322. Time of the work has been established.

The composition of multiple launch rocket systems "Hurricane" includes:
9P140 combat vehicle;
Transport-9T452;
Rockets
KAUO (a complex of automatic fire control) 1V126 "Skit-B";
Training facilities;
Car surveying 1T12-2M;
Radiopelengatsionny Meteorological Complex 1B44;
A set of special equipment and tools of the Arsenal 9F381

9P140 combat vehicle carried on a four-ZIL-135LMP with high maneuverability and 8×8. Artillery is part of the package, which collected sixteen tubular rails, swivel base with adjustable sights and targeting mechanisms, the balancing mechanism, and hydraulic and electrical equipment. Guidance mechanisms, equipped with actuators make it possible to direct the vertical rails package from 5 to 55 degrees. The angle of the horizontal guidance is ± 30 degrees from the longitudinal axis of the war machine. To increase resistance launcher during firing in the rear of the chassis has two legs that are kitted out jacks actuated manually. Rockets can be transported specifically in the guide. Fighting vehicle equipped with night vision devices and communications (radio R-123M).

Tubular guide — a smooth-walled pipe U-shaped helical groove in which slides during firing pin missile. So Makar, provided its initial promotion to give the projectile resistance required in flight. **Shell** when moving along the trajectory of rotation is maintained by drop stabilizer blades which are mounted to the longitudinal axis of the projectile at a predetermined angle. Volley one combat vehicle covers an area of over 42 hectares. The main method of shooting is **fire** closed position. There is a possibility of firing from the cabin. The calculation of the combat vehicle 9P140 — 6 people (4 people in peacetime) combat vehicle commander, driver, gunner (senior gunner), numbers of calculation (3 people).

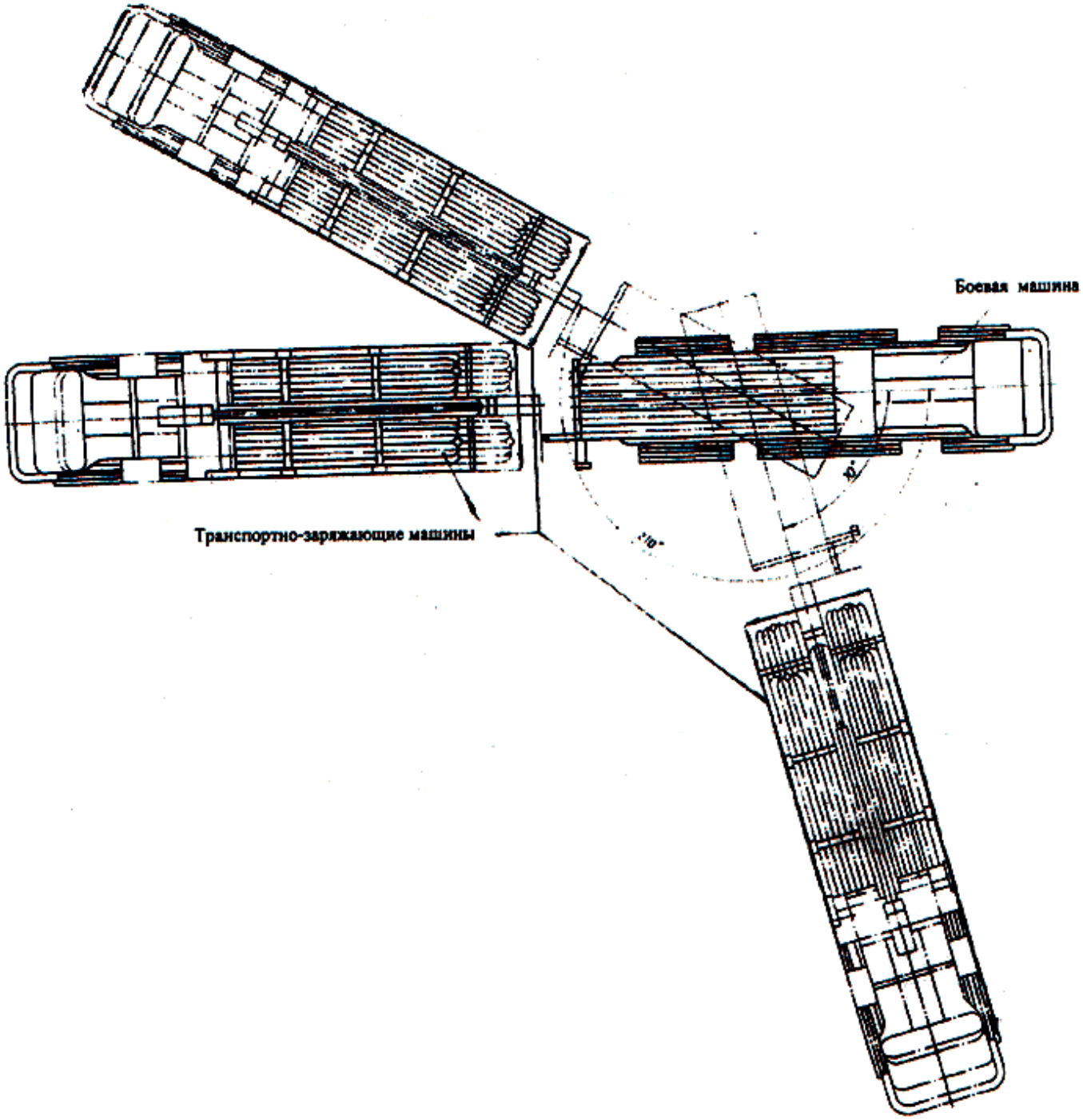
Package rails mounted on the cradle — welded rectangular platform. Cradle to the upper machine is connected to a 2-semi-axes around which it swings (turns) when you hover over the angles of elevation. Totality of cradle package guides, a number of units and details of the mechanism locking the bracket's run, the ignition system and other is swinging part. With the rotati
ng part of the war machine is attached to a suitable package guides the azimuthal angle. The spinning part consists of a swinging part of the upper machine, balancing, lifting and rotating mechanism, overhead, ground gunner hand drive homing mechanism for locking the oscillating part of the attachment bracket swinging, rotating part of the locking mechanism. Equilibrating mechanism with a partial compensation since the weight of the rocker. It consists of a pair of mounting parts and torsion bars. Rotary and lifting mechanisms are for the guidance of aiming in the horizontal plane and in elevation. The main method of guidance is electric. In the repair and used in the event of manual drive. Locking mechanisms are fixed movable parts of the machine in motion. Check valves rocking of the unloaded hoist while shooting and prevented sbivaemost lead on the elevation angle.

On the military machine has a mechanical panoramic sight D726-45. As the angle measuring and sighting devices in full-time use of the gun sight panorama PG-1M.

System start-9P140 combat vehicle is provided by:
— benign **work** calculation which serves a fighting machine with the shooting;
— conducting volley and a single lamp when in the cockpit of calculation;
— conducting volley and a single lamp when in the shelter based on distance of 60 meters from **battle** machine;
— firing in the event of failure of the power supply and the main circuit blocks firing.

Starting system it is possible to volley fire with the same rate (16 missile launch occurs at a rate of 0.5 seconds) and the so-called the "ragged" rate of fire (the first 8 missiles launched at intervals of 0.5 seconds, the other missiles at intervals of 2 seconds) . Through the use of "ragged" rate of fire can significantly reduce the frequency and amplitude of the oscillation war machine, and how to make better accuracy of fire.

For loading the launcher used freight-loading **machine** 9T452, developed on a similar machine with combat gear. Any 9T452 can carry 16 missiles. The machine provides loading (unloading) without special. training positions, including at least some of the transport vehicle, other transport and loading vehicle or from the ground. Reloading process is mechanized, charging time 15 minutes. Load capacity of 300 kg.



Equipment transport and loading vehicle consists of a frame, a crane, a tray rammer, trolleys, lifting devices, the site operator, devices for docking, boom, slewing gear, electric equipment, machinery alignment, spare parts. Tray with rammer — folding prop on which the plunger moves the missile. Axis alignment mechanism smoothes the missile which is in the tray, and the axis of the guide tube. The left-hand and right-hand carts are designed to accommodate missiles. Transport-loading machine has three drive which produce: lifting / lowering of the missiles, rotating crane, chambering a missile into the guide.

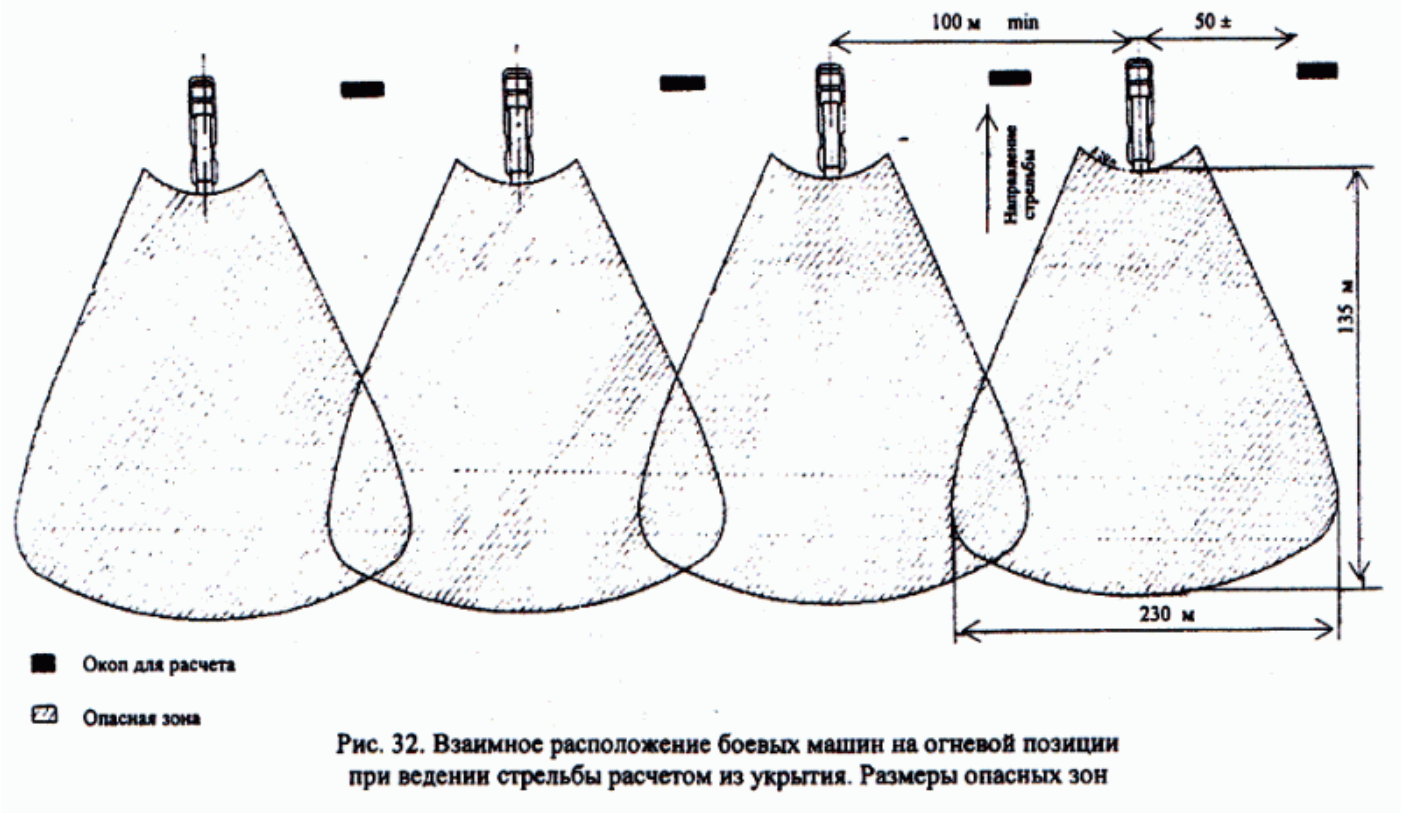


Рис. 32. Взаимное расположение боевых машин на огневой позиции при ведении стрельбы расчетом из укрытия. Размеры опасных зон

Loading the war machine is done in the following order from the top tiers: lift rocket, put it in the tray, unhook the lifting devices, hand in these rocket into the guide.

Feature a four-wheel chassis ZIL-135LMP was the placement of the power plant for the four-seater cockpit. This power plant consisted of a 2-eight-cylinder V-type carburetor engines ZIL-375. At 3200 revolutions per minute, each engine has an output of 180 hp The box has a circuit board: each side of the spinning wheel independent engine through a separate box, final drives and transfer cases. The wheels of the first and fourth axis — managed, with independent torsion bar suspension has leaf springs. Wheels secondary axles close together, have an elastic suspension and the frame fastened aggressively. The machine is equipped with a centralized tire pressure regulation. The machine has the very highest throughput and speed properties. When driving with a full load on the highway the maximum speed is 65 km per hour, without preparatory training can Fording depth of 1.2 meters. On the progress of the combustible in store is 500 km.

Ammunition of multiple launch rocket systems "Hurricane" is composed of the following missiles:
— 9M27F having a high-explosive warhead;
— 9M27K cassette having a head portion with fragmentation submunitions;
— 9M27S having incendiary warhead;
— 9M59, 9M27K2, 9M27K3 with submunitions with anti-tank mines;
— 9M51 headquartered part FAE act (during the war in Afghanistan showed the highest efficiency).

Most firing range — 35 sq m, for the destruction of at least distances to **jet** the shell put on the ring, which inhibit it in flight. Flight distance cassette shell with a small ring of 11-22 km, unguided rocket 9M27F is 8 — 21 km. In the case of the huge braking range cassette shell is 9 — 15 km, and the projectile 9M27F is 8 — 16 km.

The complex can be used in the criteria for enemy use of nuclear, bacteriological, chemical weapons at different times of day and year, with an air temperature of -40 … +50 ° C. in different weather criteria.

Multiple rocket launcher "Hurricane" can be transported aqua, train or air.

The performance properties of the 9P140 MLRS MLRS "Hurricane":
Mass combat vehicles in a combat situation — 20 tons;
Mass combat vehicles without calculation and shells — 15.1 tons;
Dimensions on the move:
Length — 9,630 m;
Width — 2.8 m;
Height — 3,225 m;
Wheel formula — 8×8
The number of guides — 16 items;
Rotation of rails — 240 degrees;
Recharge time — 15 minutes;
In store down the highway — 500 km;
Transfer time combat vehicle from traveling into the firing position less — 3 minutes;
While leaving a firing position after making volley least — 1.5 minutes;
Temperature range of combat implementation — from -40 to +50 ° C;
Surface wind — up to 20 m / s;
Relative humidity at 20 ° C. .. 25 — 98%;
Dustiness of surface air — to 2 g/m3;
Altitude above sea level implementation — to 3000 m;
General properties of rockets:
Calibre — 220 mm
Weight of the solid powder charge — 104.1 kg
Most firing range — 35 km;
Short range shooting — 8 km;
Temperature range combat use — from -50 to +50 ° C;
Temperature range of the short-term (up to 6 hours) stay the PC — from -60 to +60 ° C.

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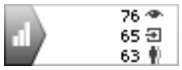
Eni has recently announced an agreement with Gazprom, on the basis of which it

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